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(12) **United States Patent**
Sun

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(54) **DOME STRUCTURE**

(71) Applicant: **Xiaoping Sun**, Trophy Club, TX (US)

(72) Inventor: **Xiaoping Sun**, Trophy Club, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

(63) Continuation-in-part of application No. 13/775,651, filed on Feb. 25, 2013, now Pat. No. 8,789,318.

(51) **Int. Cl.**

E04B 7/08	(2006.01)
F16B 5/00	(2006.01)
E04H 9/14	(2006.01)
E04B 1/32	(2006.01)

(52) **U.S. Cl.**

CPC ***F16B 5/0004*** (2013.01); ***E04B 1/3211*** (2013.01); ***E04H 9/14*** (2013.01); *E04B 2001/3241* (2013.01); *E04B 2001/3282* (2013.01); *Y10T 403/28* (2015.01); *Y10T 403/44* (2015.01)

(58) **Field of Classification Search**

CPC . E04B 1/3211; E04B 2001/3282; E04H 9/14; E04H 9/028; F16B 5/0004

USPC 52/81.3, 81.1

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,978,074	A *	4/1961	Schmidt	52/81.2
3,002,590	A *	10/1961	Hannoosh et al.	52/81.2
3,802,132	A *	4/1974	Sumner	52/81.3
4,092,810	A *	6/1978	Sumner	52/81.4
4,262,461	A *	4/1981	Johnson et al.	52/81.3
4,464,073	A *	8/1984	Cherry	403/170
4,750,807	A *	6/1988	Chamayou dit Felix	359/451
8,347,561	B2 *	1/2013	Howe	52/81.3
8,789,318	B1 *	7/2014	Sun	52/81.3
2002/0112413	A1 *	8/2002	Hoberman	52/71
2006/0288950	A1 *	12/2006	Cartwright et al.	119/223

* cited by examiner

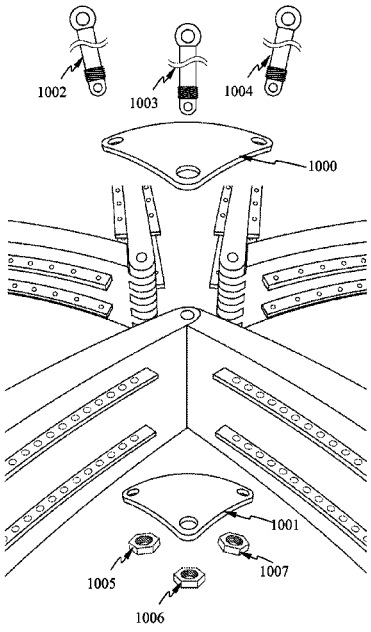
Primary Examiner — Basil Katcheves

(74) *Attorney, Agent, or Firm* — IPro, Inc.; Na Xu

(57) **ABSTRACT**

Described herein is a structure that comprises a plurality of spherical triangular units on a plurality of levels. The structure has a superior ability to survive disasters such as tornadoes, hurricanes, earthquakes etc. It is cost-efficient, energy efficient, extremely durable and easily maintained. The plurality of spherical triangular units on one level of the plurality of levels are essentially identical to each other, and are essentially equally spaced radially relative to a center of the sphere; each of the plurality of spherical triangular units comprises three planar panels, each with an end surface comprising a minor arc of a great circle of the sphere; a spherical triangular unit on a level above the first level of the structure is configured to be joined with two neighboring spherical triangular units on the level below; the structure is substantially a dome.

27 Claims, 15 Drawing Sheets



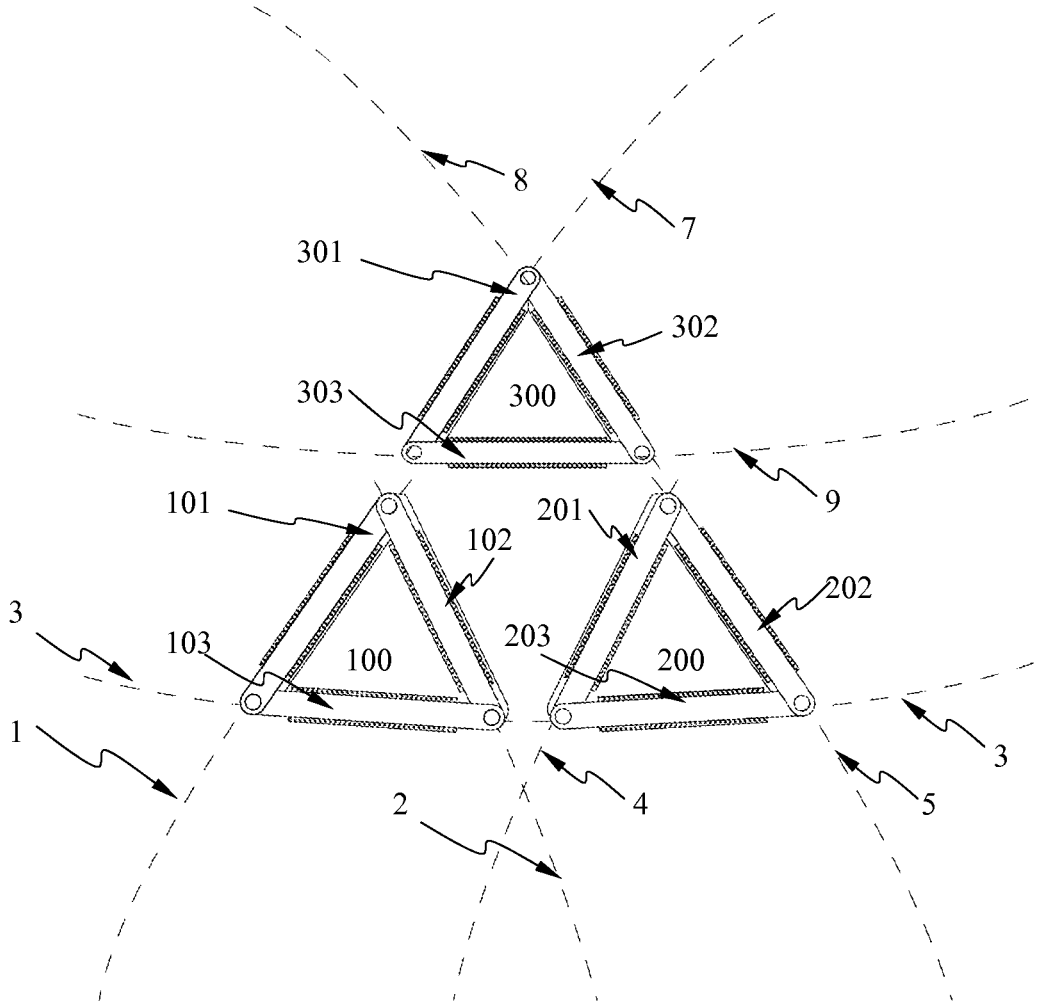


Figure 1

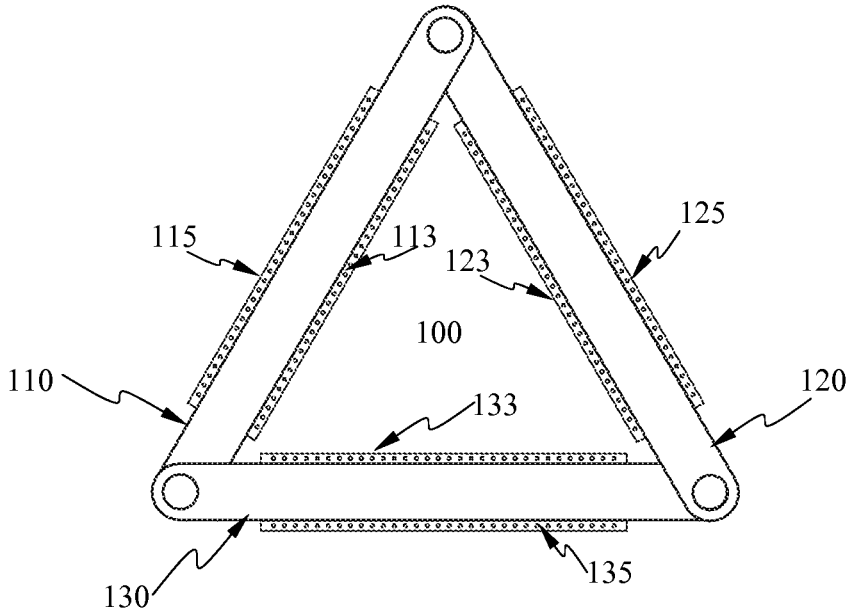
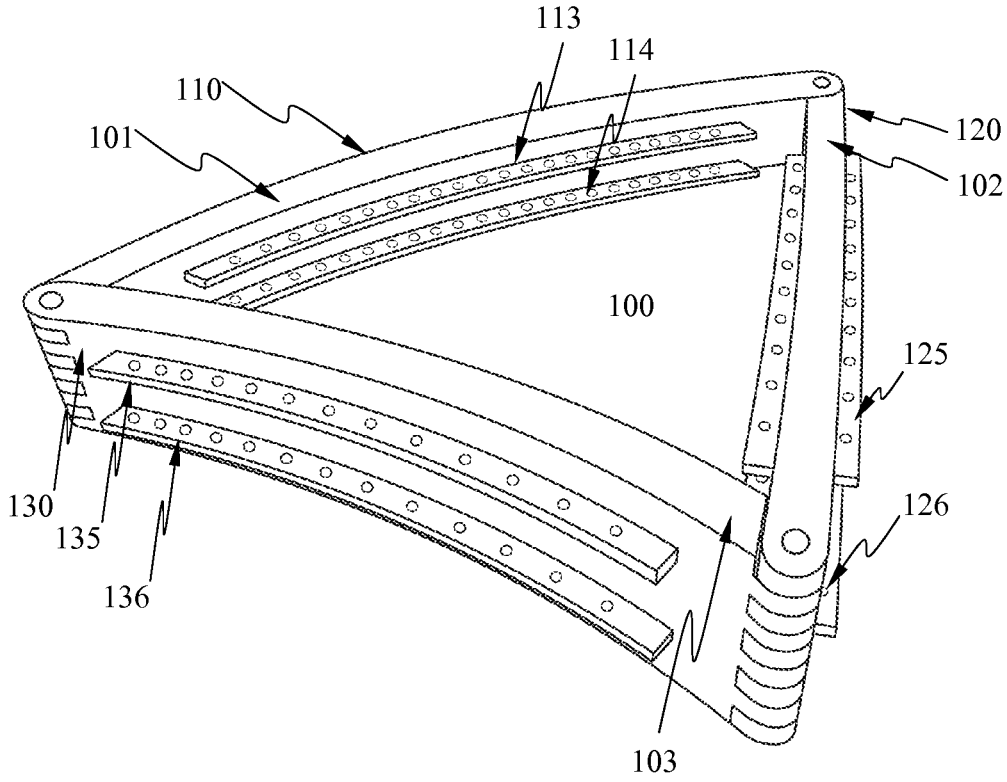


Figure 2



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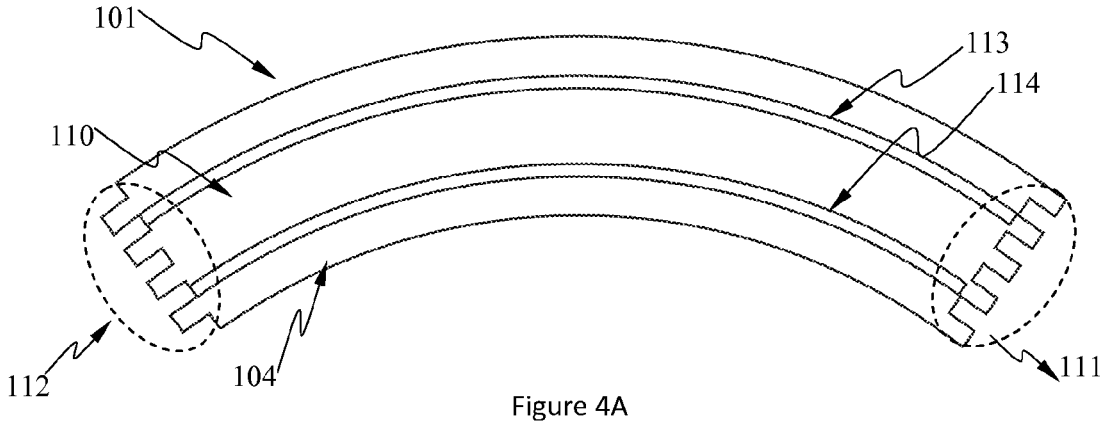


Figure 4A

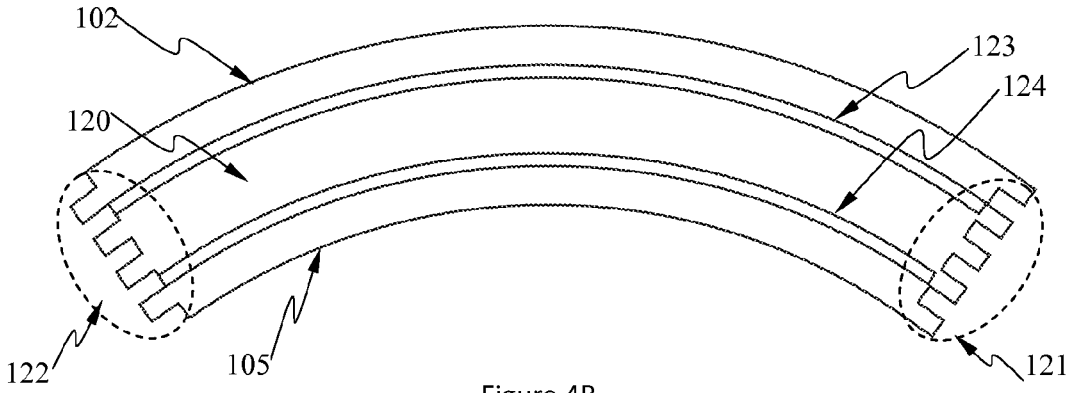
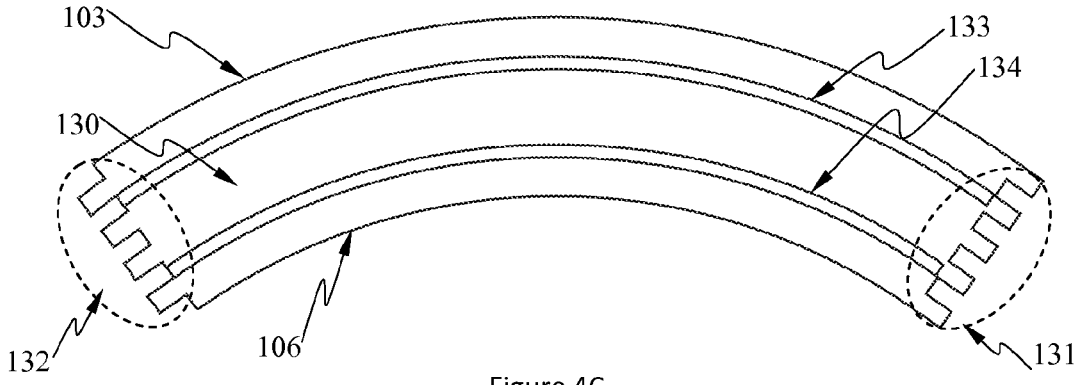


Figure 4B



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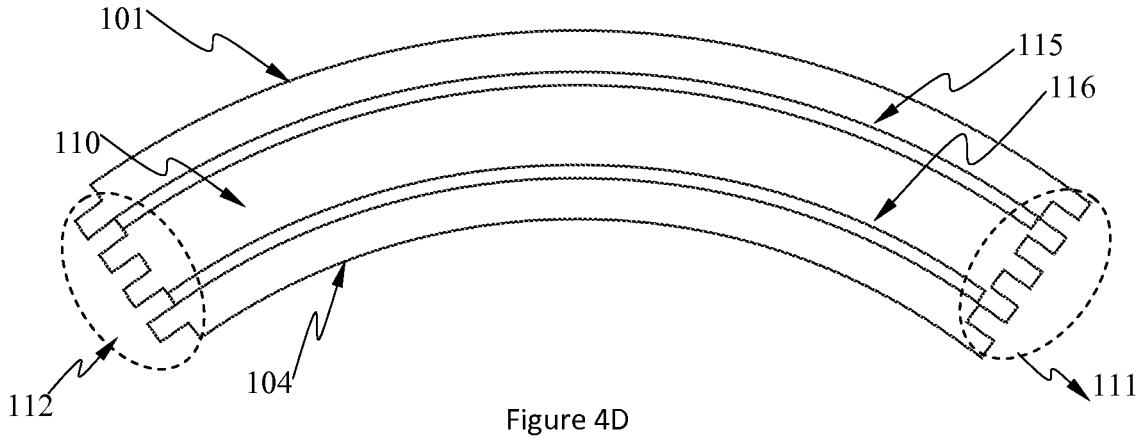

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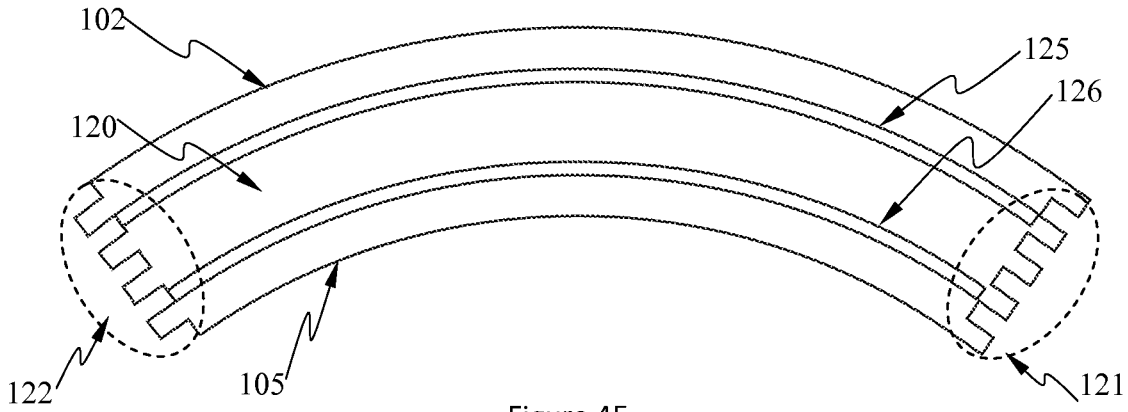

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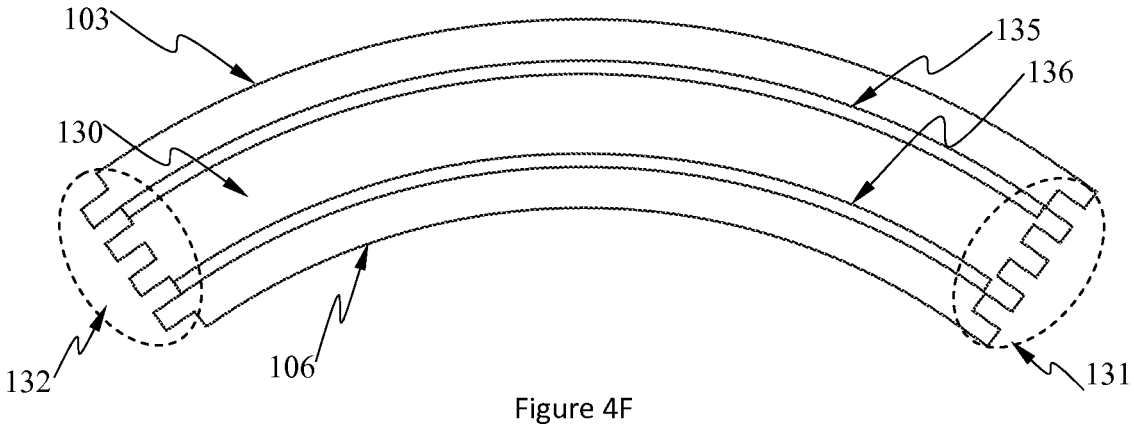

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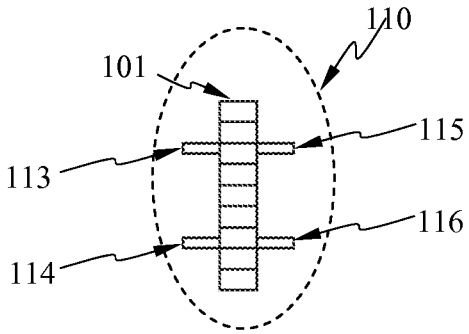

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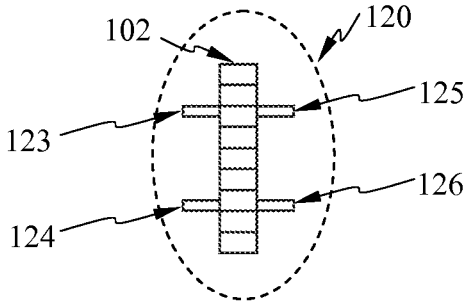

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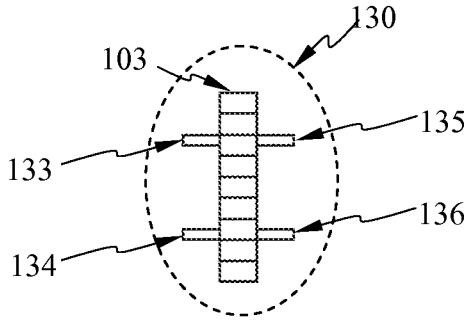
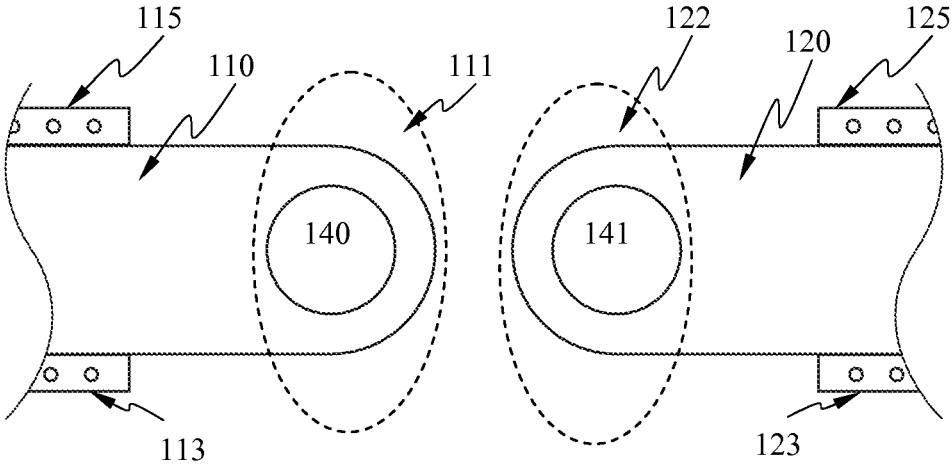


Figure 4I



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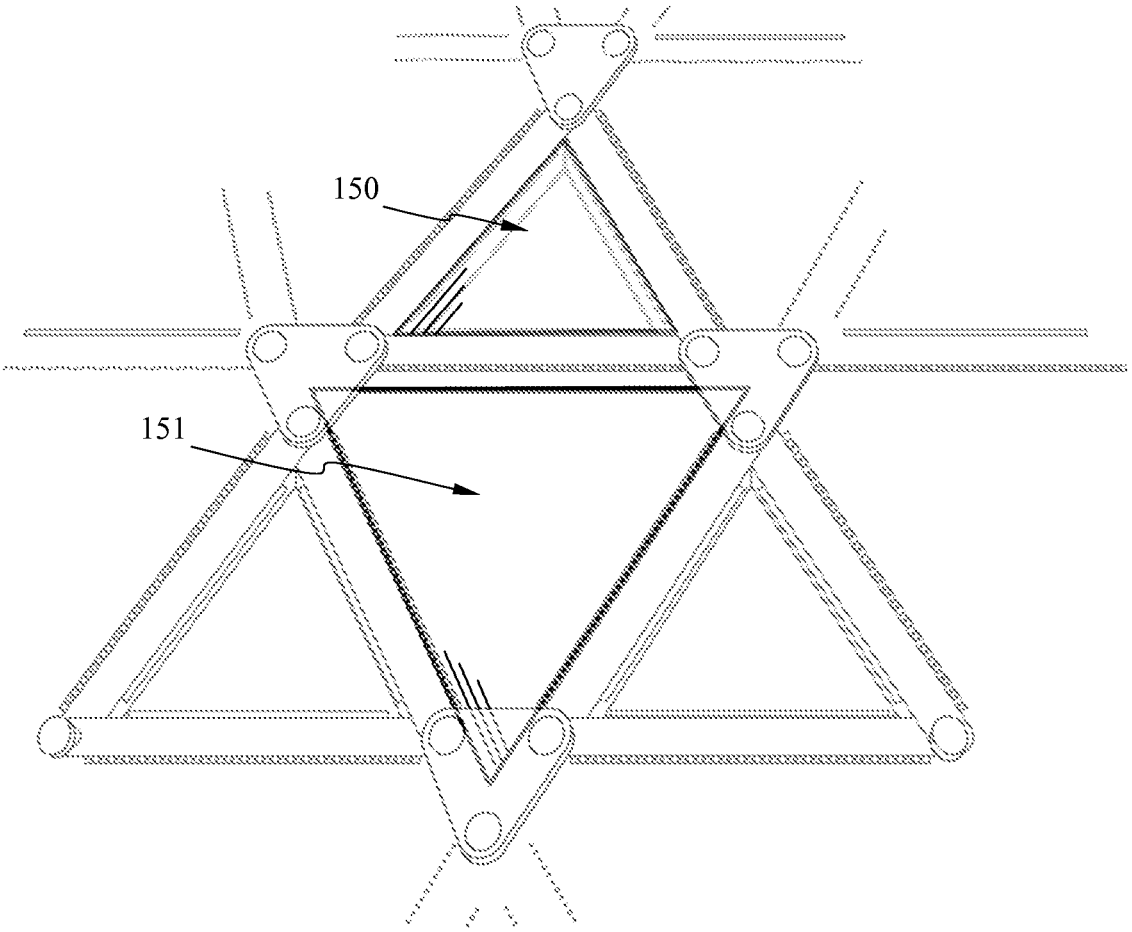

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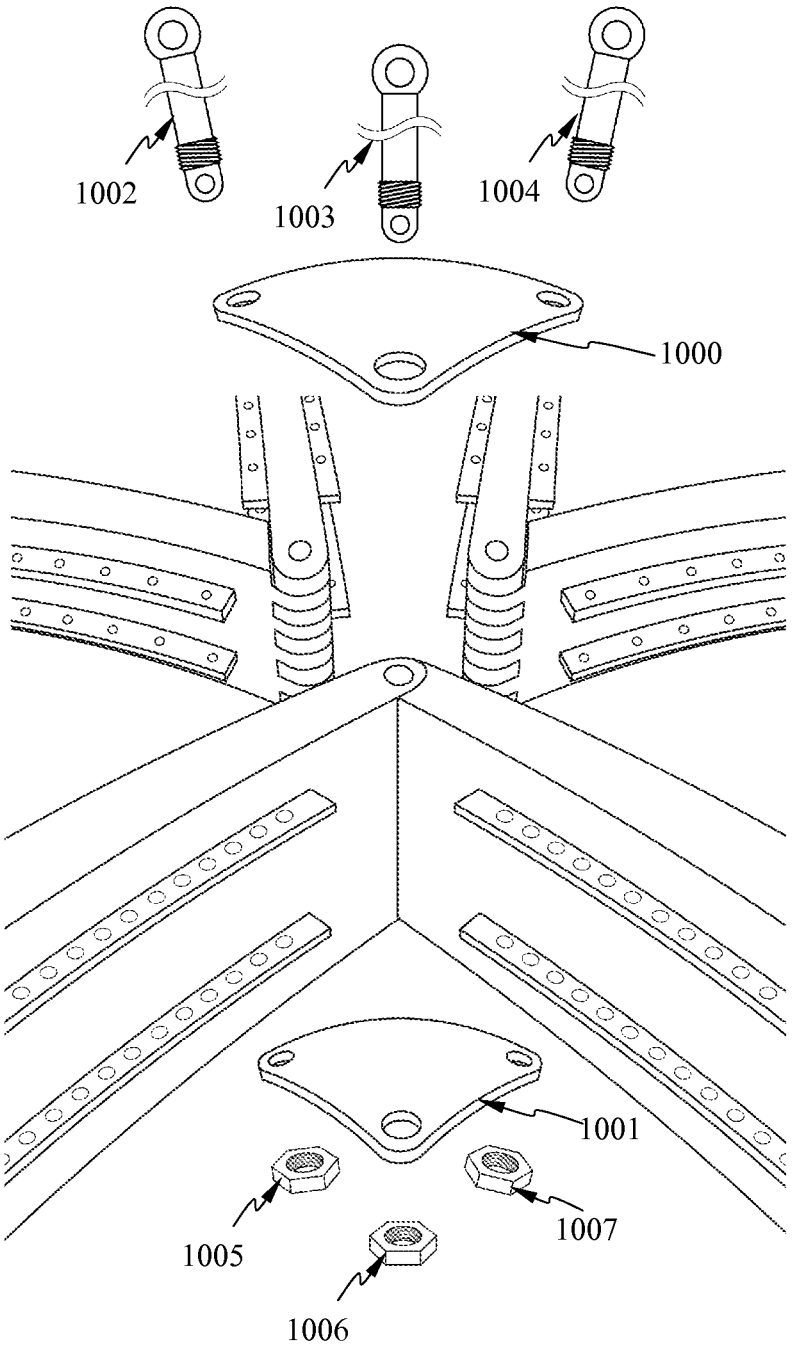

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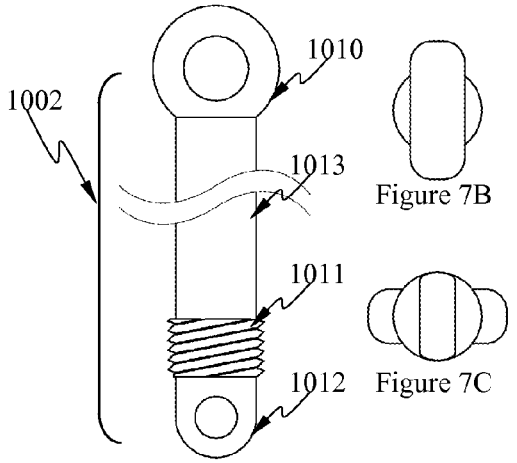
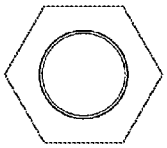


Figure 7A

Figure 7B

Figure 7C



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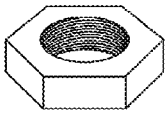

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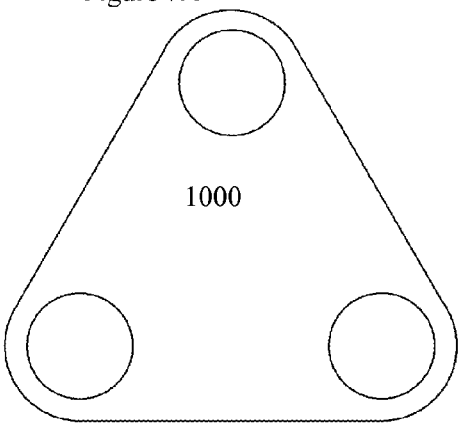

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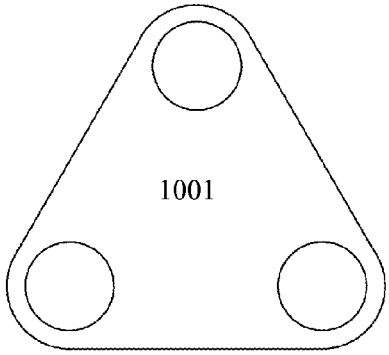

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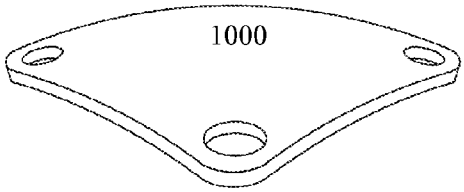

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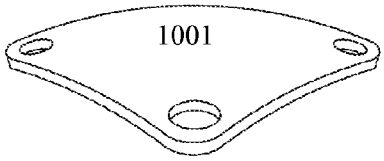


Figure 7I

Figure 7

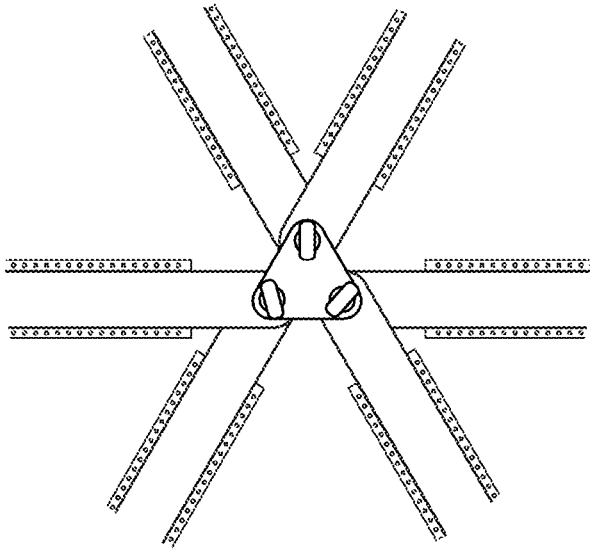


Figure 8A

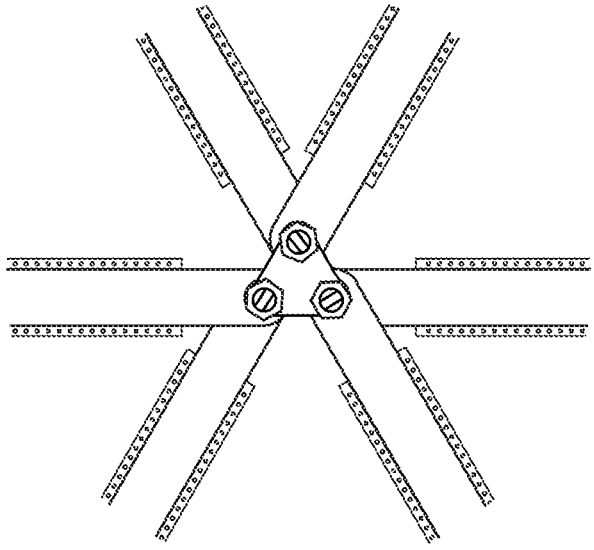
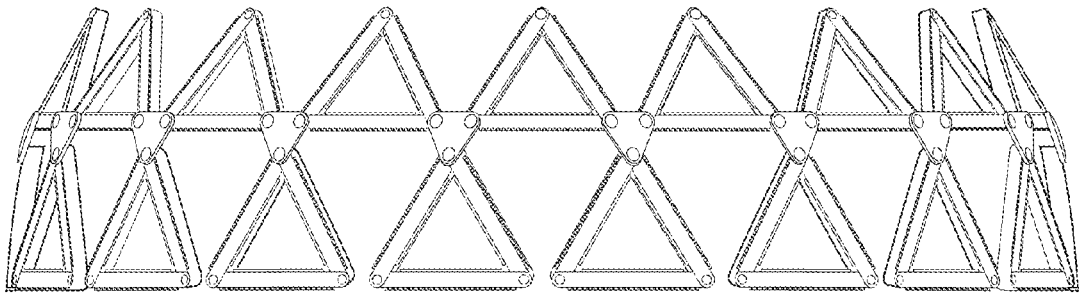


Figure 8B



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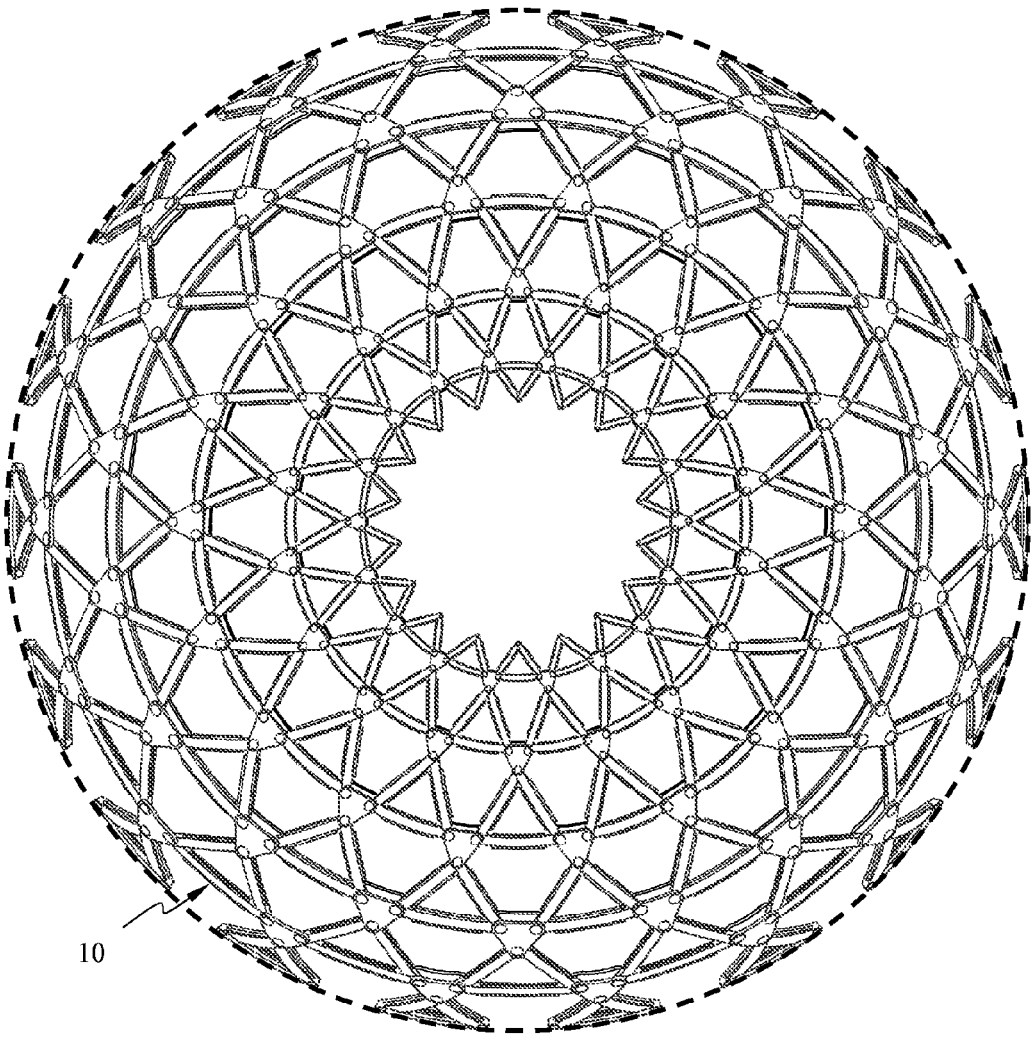

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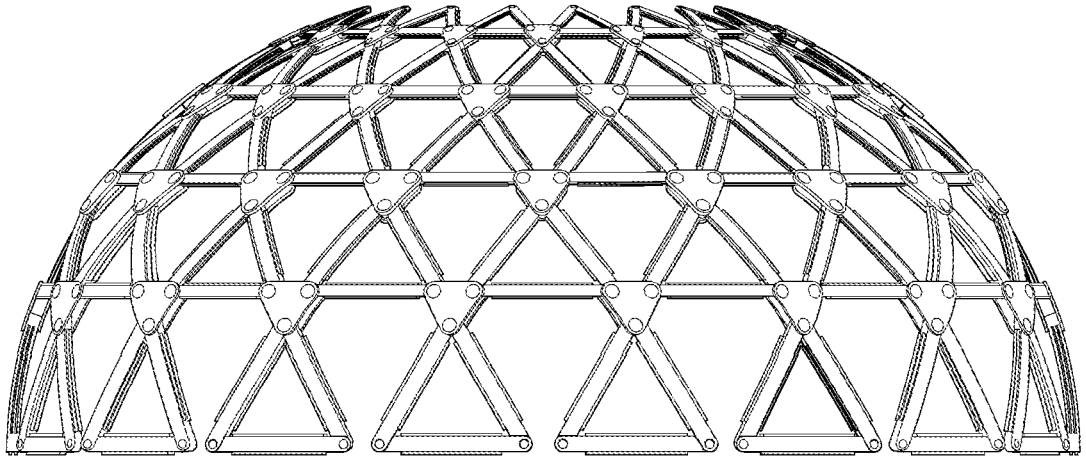

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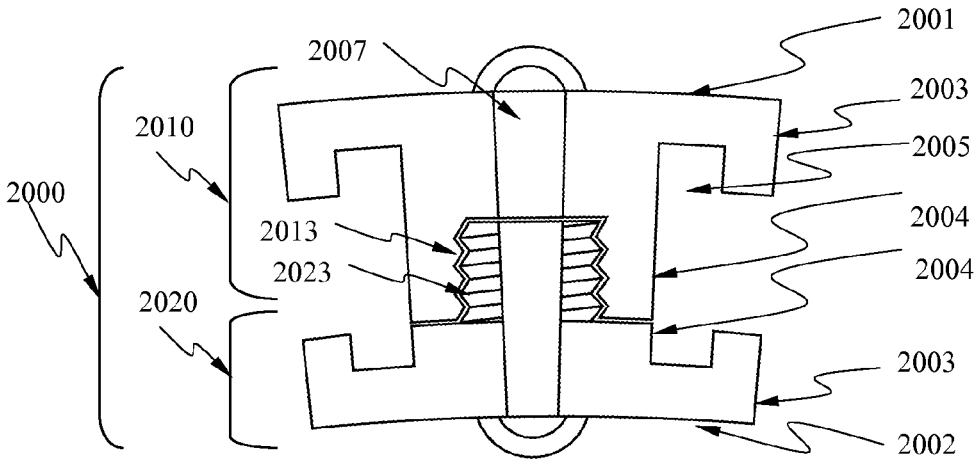
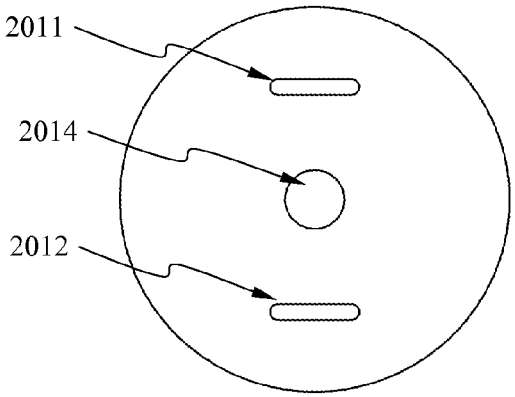


Figure 12A



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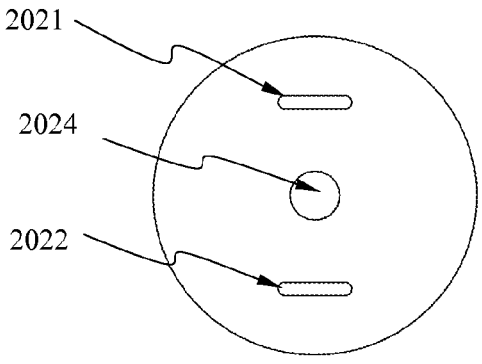


Figure 12C

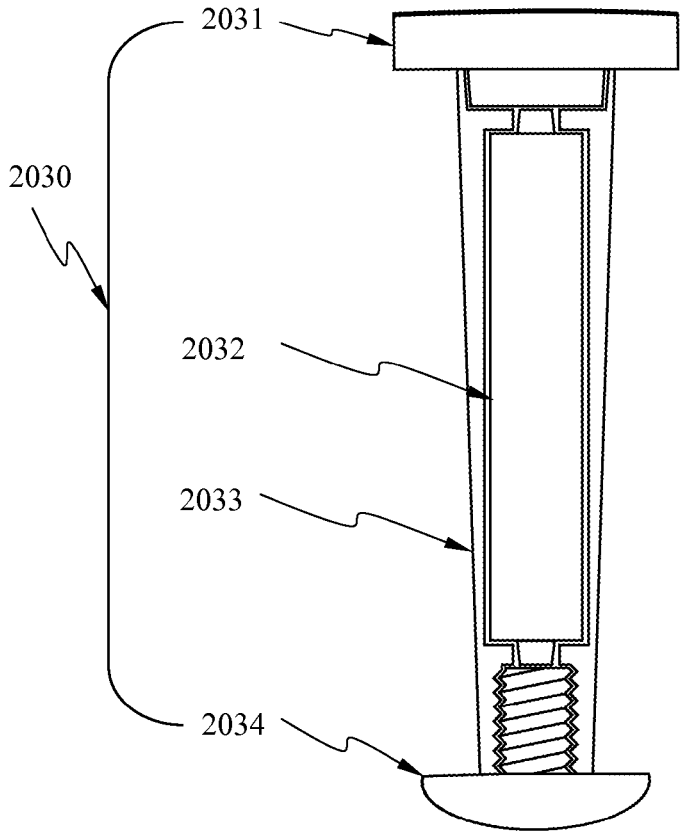
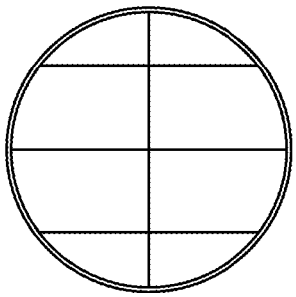


Figure 13A



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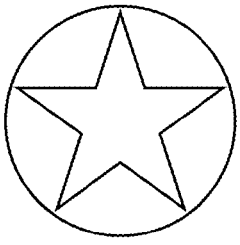

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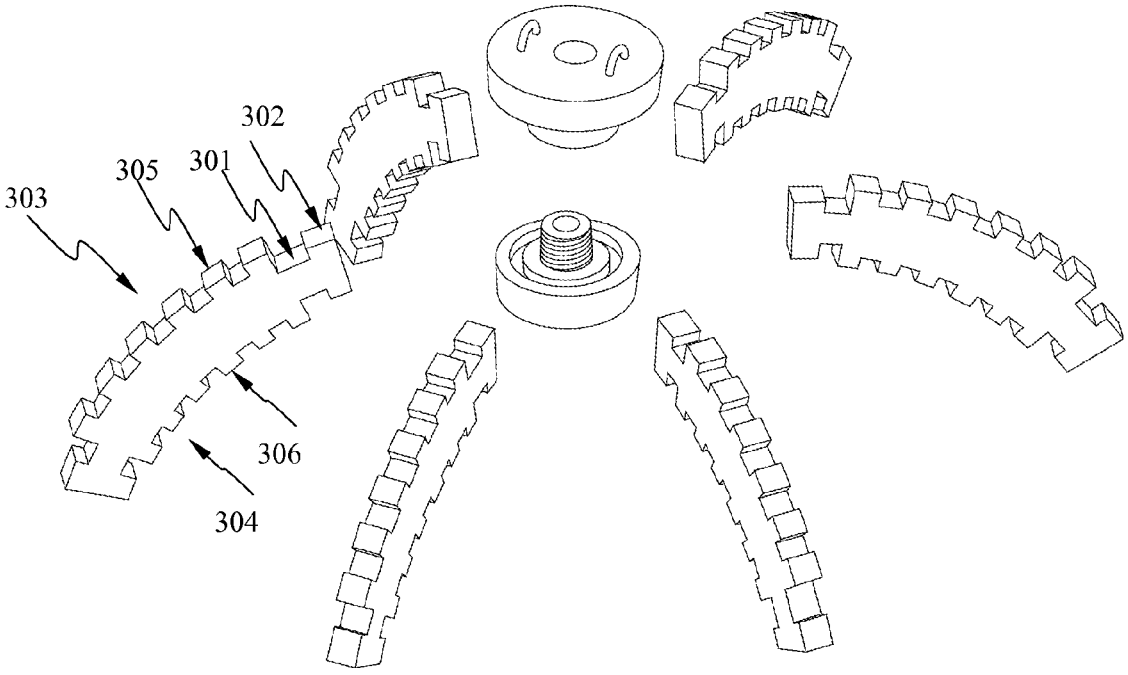

Figure 14

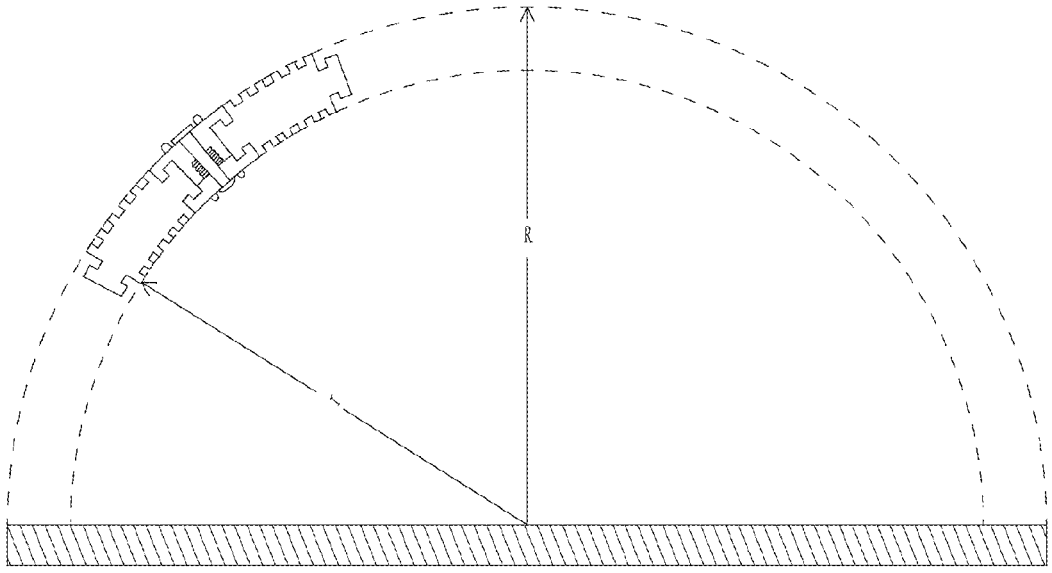

Figure 15

DOME STRUCTURE

BACKGROUND

Emergency shelters are structures built for residence and dwelling during or after a manmade or natural disaster, such as a fire, flood, tornado or earthquake. In some disasters such as tornadoes, survival depends heavily on the mechanical strength and quality of the emergency shelters. Temporary emergency shelters available on the market that are adaptable to individual use, such as inexpensive tents, lack the necessary strength, durable quality, and environmental conformability for survival during a natural disaster. Emergency shelters that overcome some of the disadvantages of temporary shelters are often built primarily for other purposes, such as schools, churches, gymnasiums, etc. They are more expensive and difficult to build, are not practical to be owned by a family, and are sometimes not available at a near distance to a person in need of survival during a disaster situation.

A spherical ball or a round ball is a three dimensional object that has a spherical surface, characterized as a perfectly round geometrical object in a three-dimensional space. A spherical surface has a set of points that are all the same distance, which is referred to as the radius of the sphere or r, from a given point in space. The given point is known as the center of the sphere. The shortest path connecting two points lying entirely in the sphere is a minor arc of the great circle passing the points. On a sphere, a central angle of an arc of a great circle is an angle spanned by the radii from each end of the arc to the center of the sphere. A plane section of a sphere is a circle. A great circle, also known as an orthodrome or Riemannian circle, of a sphere is the intersection of the sphere and a plane which passes through the center point of the sphere, as opposed to a general circle of a sphere where the plane is not required to pass through the center. A sphere may be divided into two equal hemispheres by any plane that passes through its center.

A spherical ball is unique in many ways. For instance, in comparison to other three dimensional objects, a spherical ball has the largest volume for the smallest surface area: the sphere has the smallest surface area among all surfaces enclosing a given volume and it encloses the largest volume among all closed surfaces with a given surface area.

For the reason above, a building structure made in resemblance to a sphere may have the benefit of lower consumption of construction materials, lower cost, more enclosed space for use, higher structural strength and better safety. Such a structure that resembles a hemisphere or the hollow upper half of a sphere is often referred to as a dome. Dome structures made of various materials have a long architectural lineage. Their prevalence in use has resulted in many types and variations, such as an onion dome, corbel dome, geodesic dome, oval dome, polygonal dome, sail dome, saucer dome, umbrella dome, etc.

SUMMARY

Described herein is a structure comprising a first spherical triangular unit, a second spherical triangular unit and a third spherical triangular unit; the first spherical triangular unit comprising a first planar panel, a second planar panel and a third planar panel; the second spherical triangular unit comprising a fourth planar panel, a fifth planar panel and a sixth planar panel; the third spherical triangular unit comprising a seventh planar panel, an eighth planar panel and a ninth planar panel; the first planar panel comprising a first end surface, the second planar panel comprising a second end surface, the third planar panel comprising a third end surface; the fourth planar panel comprising a fourth end surface, the fifth planar panel comprising a fifth end surface, and the sixth planar panel comprising a sixth end surface; the seventh planar panel comprising a seventh end surface, the eighth planar panel comprising an eighth end surface, and the ninth planar panel comprising a ninth end surface.

Wherein the first end surface comprises a minor arc of a first great circle of a sphere; wherein the second end surface comprises a minor arc of a second great circle of the sphere; wherein the third end surface comprises a minor arc of a third great circle of the sphere; wherein the fourth end surface comprises a minor arc of a fourth great circle of the sphere; wherein the fifth end surface comprises a minor arc of a fifth great circle of the sphere; wherein the sixth end surface comprises a minor arc of the third great circle of the sphere; wherein the seventh end surface comprises a minor arc of a seventh great circle of the sphere; wherein the eighth end surface comprises a minor arc of an eighth great circle of the sphere; wherein the ninth end surface comprises a minor arc of a ninth great circle of the sphere.

Wherein the seventh planar panel and the ninth planar panel join and form a corner of the third spherical triangular unit, the first planar panel and the second planar panel join and form a corner of the first spherical triangular unit, the corner of the first spherical triangular unit is connected to the corner of the third spherical triangular unit; and wherein the eighth planar panel and the ninth planar panel join and form another corner of the third spherical triangular unit, the fourth planar panel and the fifth planar panel join and form a corner of the second spherical triangular unit, the other corner of the third spherical triangular unit is connected to the corner of the second spherical triangular unit.

According to an embodiment of the structure, central angles of the first end surface, second end surface, third end surface, fourth end surface, fifth end surface and sixth end surface are essentially the same. As used herein, a central angle of an end surface comprising an arc is the central angle of the arc.

According to an embodiment of the structure, central angles of the seventh, eighth and ninth end surfaces are essentially the same.

According to an embodiment of the structure, the first planar panel extends from the first end surface toward a center of the sphere along a surface of the first great circle; the second planar panel extends from the second end surface toward the center of the sphere on a surface of the second great circle; and the third planar panel extends from the third end surface toward the center of the sphere on a surface of the third great circle.

According to an embodiment of the structure, the first planar panel extends from the first end surface to a first inner end surface which comprises arc concentric with the first end surface; wherein the second planar panel extends from the second end surface to a second inner end surface which comprises an arc concentric with the second end surface; wherein the third planar panel extends from the third end surface to a third inner end surface which comprises an arc concentric with the third end surface.

According to an embodiment of the structure, central angles of the first, second, and third inner end surfaces are essentially the same.

According to an embodiment of the structure, radii of the first, second, and third inner end surfaces are essentially the same.

According to an embodiment of the structure, the first and the second planar panel are joined by a hinge; the second and

third planar panels are joined by a hinge; the first and third planar panels are joined by a hinge. Preferably, the hinge is a butt hinge.

According to an embodiment, the structure further comprises one or more intra-triangular-unit covers; the first, second and third planar panels comprise one or more inner ridges configured to accept or secure the one or more intra-triangular-unit covers, that are configured to fit into and cover an intra-unit opening of the first triangular unit.

According to an embodiment the structure further comprises one or more inter-triangular-unit covers; the first, second and third planar panels comprise one or more outer ridges configured to accept or secure the one or more inter-triangular-unit covers, that are configured to fit into and cover an inter-unit opening of adjacent spherical triangular units. According to an embodiment, the first, second and third spherical triangular units are adjacent spherical triangular units.

According to an embodiment, when there are two or more intra-triangular-unit covers, the structure further comprises a material filled between the two or more intra-triangular-unit covers.

According to an embodiment, when there are two or more inter-triangular-unit covers, the structure further comprises a material filled between the two or more inter-triangular-unit covers.

According to an embodiment, the structure further comprises a plurality of plates, configured to connect the first spherical triangular unit to the third spherical triangular unit and to connect the second spherical triangular unit to the third spherical triangular unit.

According to an embodiment, the structure further comprises a plurality of fasteners configured to join the plurality of plates to the first, second or third spherical triangular units through a plurality of through holes on the first, second and third spherical triangular units.

According to an embodiment of the structure, at least one of the plurality of fasteners comprises a ring configured to accept wiring therethrough.

According to an embodiment of the structure, at least one of the first, second and third planar panels comprise a material selected from a group consisting of aluminum, iron, steel, glass fiber, carbon fiber, plastic, wood and a combination thereof.

According to an embodiment of the structure, the ninth great circle passes through an intersection of the first end surface and the second end surface and passes through an intersection of the fourth end surface and the fifth end surface; wherein the ninth end surface is a minor arc of the ninth circle between the intersection of the first end surface and the second end surface and the intersection of the fourth end surface and the fifth end surface.

According to an embodiment, the structure further comprises a first plurality of spherical triangular units, each of which is essentially identical to the first spherical triangular unit; the second spherical triangular unit is essentially identical to the first spherical triangular unit; wherein the first plurality of spherical triangular units and the first and second spherical triangular units are essentially equally spaced radially along the third great circle, and constitute a first level of the structure.

According to an embodiment, the structure further comprises a second plurality of spherical triangular units, each of which is essentially identical to the third spherical triangular unit; wherein the second plurality of spherical triangular units and the third spherical triangular unit are essentially equally spaced radially along the ninth great circle, and constitute a second level of the structure.

According to an embodiment, the structure further comprises a plurality of levels comprising a plurality of spherical triangular units; the plurality of spherical triangular units on one level of the plurality of levels are essentially identical to each other, and are essentially equally spaced radially relative to a center of the sphere; each of the plurality of spherical triangular units located on a level above the first level comprises three planar panels, each with an end surface comprising a minor arc of a great circle of the sphere; a spherical triangular unit on a level above the first level of the structure is configured to be joined with two neighboring spherical triangular units on the level below; the structure is substantially a dome.

According to an embodiment, the structure comprises a connector. The connector comprises an upper wall, a lower wall, one or more outer circular walls and one or more inner circular walls. One of the one or more outer circular walls is an extended part of the upper wall or the lower wall. One of the one or more outer circular walls and one of the one or more inner circular walls are configured to form a circular slot.

According to an embodiment, the inner and outer circular walls and the circular slots are in cylindrical shapes.

According to an embodiment, the inner and outer circular walls and the circular slots are in conical or funnel shapes.

According to an embodiment, the connector is configured to accommodate a plurality of ends of a plurality of planar panels in the circular slot to connect a plurality of spherical triangular units.

According to an embodiment, the connector connects an end of each of planar panels of three adjacent spherical triangular units to connect three adjacent spherical triangular units.

According to an embodiment, the connector comprises a top connector piece and a bottom connector piece. The top connector piece comprises an upper wall and an inner circular wall. The bottom connector piece comprises a lower wall and an inner circular wall. The top connector piece and the bottom connector piece are configured to be securely joined.

According to an embodiment, the top connector piece further comprises a first top handle and a second top handle; the bottom connector piece further comprises a first bottom handle and a second bottom handle.

According to an embodiment, the top connector piece comprises an internal thread; the bottom connector piece comprises an external thread. The top connector piece and the bottom connector piece are joined by the internal thread and the external thread.

According to an embodiment, the top connector piece comprises a top through hole in a center of the top connector piece; the bottom connector piece comprises a bottom through hole in a center of the bottom connector piece. The top through hole and the bottom through hole are configured to align to form a holding space.

According to an embodiment, the structure further comprises a control system, a power cable or system, a security system, an energy generation system, a heating system, a communication cable or system, a transmission cable or system, a food or water transit cable or system, a display or notification system, an alarm system, a speaker system, a battery system, an air conditioning system, a filtration system, a lighting system, or a device or a material that is adapted to provide for life and survival.

According to an embodiment, the structure further comprises a lighting device in the holding space.

According to an embodiment, the lighting device comprises a solar panel, a battery, a casing, and a LED light.

According to an embodiment, each end of a planar panel comprises a stem and a head. The head is configured to fit in the circular slot, and engaged by the upper wall, the lower wall and the inner and outer circular walls.

According to an embodiment, the structure further comprises a first plurality of spherical triangular units, each of which is essentially identical to the first spherical triangular unit; the second spherical triangular unit is essentially identical to the first spherical triangular unit; wherein the first plurality of spherical triangular units and the first and second spherical triangular units are essentially equally spaced radially along the third great circle, and constitute a first level of the structure.

According to an embodiment, the structure further comprises a second plurality of spherical triangular units, each of which is essentially identical to the third spherical triangular unit; wherein the second plurality of spherical triangular units and the third spherical triangular unit are essentially equally spaced radially relative to a center of the sphere, and constitute a second level of the structure.

According to an embodiment, the structure further comprises a plurality of spherical triangular units; the plurality of spherical triangular units on one level of the plurality of levels are essentially identical to each other, and are essentially equally spaced radially relative to a center of the sphere; each of the plurality of spherical triangular units located on a level above the first level comprises three planar panels, each with an end surface comprising a minor arc of a great circle of the sphere; a spherical triangular unit on a level above the first level of the structure is configured to be joined with two neighboring spherical triangular units on the level below; the structure is substantially a dome.

Described herein is a connector which comprises an upper wall, a lower wall, one or more outer circular walls and one or more inner circular walls; wherein one of the one or more outer circular walls is an extended part of the upper wall or the lower wall. One of the one or more outer circular walls and one of the one or more inner circular walls are configured to form a circular slot between the outer circular wall and the inner circular wall. The connector is configured to accommodate a plurality of ends of a plurality of planar panels in the circular slot to connect the plurality of planar panels.

According to an embodiment, the connector further comprises a top connector piece and a bottom connector piece. The top connector piece comprises the upper wall and one of the one or more inner circular walls. The bottom connector piece comprises the lower wall and one of the one or more inner circular walls. The top connector piece and the bottom connector piece are configured to be joined.

According to an embodiment, the top connector piece further comprises a first top handle and a second top handle. The bottom connector piece further comprises a first bottom handle and a second bottom handle.

According to an embodiment, the top connector piece further comprises an internal thread; the bottom connector piece comprises an external thread. The top connector piece and the bottom connector piece are joined by the internal thread and the external thread.

According to an embodiment, the top connector piece further comprises a top through hole in a center of the top connector piece. The bottom connector piece comprises a bottom through hole in a center of the bottom connector piece; wherein the top through hole and the bottom through hole are aligned to form a holding space.

According to an embodiment, the connector further comprises a lighting device in the holding space. The lighting device comprises a solar panel, a battery, a casing, and a LED light.

Described herein is an apparatus comprising said connector.

According to an embodiment, the apparatus is a toy, a game, a model or a tool.

BRIEF DESCRIPTION OF FIGURES

FIG. **1** shows an embodiment of the structure showing a first spherical triangular unit, a second spherical triangular unit and a third spherical triangular unit.

FIG. **2** is a front view of the first spherical triangular unit in the structure according to an embodiment.

FIG. **3** is a perspective view of the first spherical triangular unit in the structure according to an embodiment.

FIG. **4**A is a bottom view of the first planar panel of the first spherical triangular unit; FIG. **4**B is a bottom view of the second planar panel of the first spherical triangular unit; FIG. **4**C is a bottom view of the third planar panel of the first spherical triangular unit; FIG. **4**D is a top view of the first planar panel of the first spherical triangular unit; FIG. **4**E is a top view of the second planar panel of the first spherical triangular unit; FIG. **4**F is a top view of the third planar panel of the first spherical triangular unit; FIG. **4**G is a side view of the first planar panel of the first spherical triangular unit; FIG. **4**H is a side view of the second planar panel of the first spherical triangular unit; FIG. **4**I is a side view of the third planar panel of the first spherical triangular unit; FIG. **4**J is a front view of the first and second planar panel of the first spherical triangular unit;

FIG. **5** shows an intra-triangular-unit cover and an inter-triangular cover according an embodiment.

FIG. **6** is an explosion view of interconnection of three spherical triangular units of the structure according to an embodiment.

FIG. **7**A is a side view of an embodiment of a fastener; FIG. **7**B is a front view of an embodiment of the fastener as shown in **7**A; FIG. **7**C is a rear view of an embodiment of the fastener as shown in **7**A; FIG. **7**D is a front view of an embodiment of a nut; FIG. **7**E is a perspective view of an embodiment of the nut as shown in **7**D; FIG. **7**F is a front view of an embodiment of an outer plate; FIG. **7**G is a front view of an embodiment of an inner plate; FIG. **7**H is a perspective view of an embodiment of the outer plate as shown in **7**F; FIG. **7**I is a perspective view of an embodiment of the inner plate as shown in **7**G.

FIG. **8**A is a front view of an interconnected portion of three spherical triangular units.

FIG. **8**B is a back view of the interconnected portion of three spherical triangular units in **8**A.

FIG. **9** is a front view of a first level and a second level of the structure according to an embodiment.

FIG. **10** is a top view of the structure being a multiple level dome, according to an embodiment.

FIG. **11** is a front view of the structure being a multiple level dome, according to an embodiment.

FIG. **12**A is a cross-sectional view of a connector according to an embodiment; FIG. **12**B is a top view of the connector in FIG. **12**A according to an embodiment; FIG. **12**C is a bottom view of the connector in FIG. **12**A according to an embodiment.

FIG. **13**A is a side view of a lighting device according to an embodiment; FIG. **13**B is a top view of the lighting device in

FIG. **13**A according to an embodiment; FIG. **13**C is a bottom view of the lighting device in FIG. **13**A according to an embodiment.

FIG. **14** is an explosion view of interconnection of three spherical triangular units of the structure according to an embodiment.

FIG. **15** is a cross-sectional view of the dome structure according to an embodiment.

DETAILED DESCRIPTION

According to an embodiment as shown in FIG. **1**, a structure comprises a first spherical triangular unit **100**, a second spherical triangular unit **200** and a third spherical triangular unit **300**. The first spherical triangular unit **100** comprises a first planar panel **110**, a second planar panel **120** and a third planar panel **130**; the second spherical triangular unit comprises a fourth planar panel **210**, a fifth planar panel **220** and a sixth planar panel **230**; the third spherical triangular unit comprises a seventh planar panel **310**, an eighth planar panel **320** and a ninth planar panel **330**.

The first planar panel **110** comprises a first end surface **101**, the second planar panel **120** comprises a second end surface **102**, the third planar panel **130** comprises a third end surface **103**; the fourth planar panel **210** comprises a fourth end surface **201**, the fifth planar panel **220** comprises a fifth end surface **202**, and the sixth planar panel **230** comprises a sixth end surface **203**; the seventh planar panel **310** comprises a seventh end surface **301**, the eighth planar panel **320** comprises an eighth end surface **302**, and the ninth planar panel **330** comprises a ninth end surface **303**.

The first end surface **101** comprises a minor arc of a first great circle **1** of a sphere **10** (see FIG. **10**). The second end surface **102** comprises a minor arc of a second great circle **2** of the sphere **10**. The third end surface **103** comprises a minor arc of a third great circle **3** of the sphere **10**. The fourth end surface **201** comprises a minor arc of a fourth great circle **4** of the sphere **10**. The fifth end surface **202** comprises a minor arc of a fifth great circle of **5** the sphere **10**. The sixth end surface **203** comprises a minor arc of the third great circle **3** of the sphere **10**. The seventh end surface **301** comprises a minor arc of a seventh great circle **7** of the sphere **10**. The eighth end surface **302** comprises a minor arc of an eighth great circle **8** of the sphere **10**. The ninth end surface **303** comprises a minor arc of a ninth great circle **9** of the sphere **10**.

Wherein the seventh planar panel **301** and the ninth planar panel **303** join and form a corner of the third spherical triangular unit **300**; the first planar panel **101** and the second planar panel **102** join and form a corner of the first spherical triangular unit **100**; the corner of the first spherical triangular unit **100** is connected to the corner of the third spherical triangular unit **300**. Wherein the eighth planar panel **302** and the ninth planar panel **303** join and form another corner of the third spherical triangular unit **300**, the fourth planar panel **201** and the fifth planar panel **202** join and form a corner of the second spherical triangular unit **200**, the other corner of the third spherical triangular unit **300** is connected to the corner of the second spherical triangular unit **200**.

As shown in FIG. **1**, central angles of the first end surface, second end surface, third end surface, fourth end surface, fifth end surface and sixth end surface are essentially the same.

As shown in FIG. **1**, central angles of the seventh, eighth and ninth end surfaces are essentially the same.

As shown in FIGS. **2-4**, the first planar panel **110** extends from the first end surface **101** toward a center of the sphere along a surface of the first great circle; the second planar panel **120** extends from the second end surface **102** toward the center of the sphere on a surface of the second great circle; and the third planar panel **130** extends from the third end surface **103** toward the center of the sphere on a surface of the third great circle.

As shown in FIG. **1**, the ninth great circle passes through an intersection of the first end surface and the second end surface and passes through an intersection of the fourth end surface and the fifth end surface; wherein the ninth end surface is a minor arc of the ninth great circle between the intersection of the first end surface and the second end surface and the intersection of the fourth end surface and the fifth end surface.

As shown in FIG. **4**A, the first planar panel **110** extends from the first end surface **101** to a first inner end surface **104** which is comprises an arc concentric with the first end surface **101**; as shown in FIG. **4**B, the second planar panel **120** extends from the second end surface **102** to a second inner end surface **105** which comprises an arc concentric with the second end surface **102**; as shown in FIG. **4**C, the third planar panel **130** extends from the third end surface **103** to a third inner end surface **106** which is comprises an arc concentric with the third end surface.

According to an embodiment of the structure, central angles of the first inner end surface **104**, second inner end surface **105**, and third inner end surface **106** are essentially the same.

According to an embodiment of the structure, radii of the first inner end surface **104**, second inner end surface **105**, and third inner end surface **106** are essentially the same.

As shown in FIG. **4**A, the first planar panel **110** comprises a hinge **111** on a first end of the first planar panel, and a hinge **112** on a second end of the first planar panel; as shown in FIG. **4**B, the second planar panel **120** comprises a hinge **121** on a first end of the second planar panel, and a hinge **122** on a second end of the second planar panel; as shown in FIG. **4**C, the third planar panel **130** comprises a hinge **131** on a first end of the third planar panel, and a hinge **132** on a second end of the third planar panel. Preferably, all the hinges are butt hinges.

As shown in FIGS. **2-3**, the first and the second planar panel are joined by a hinge **111** with a hinge **122**; the second and third planar panels are joined by a hinge **121** with a hinge **132**; the first and third planar panels are joined by a hinge **112** with a hinge **131**. Preferably, all the hinges are butt hinges.

As shown in FIGS. **2-3** and FIG. **4**J, the hinges comprise through holes configured to allow two adjoining hinges to be secured together by a fastener. As shown in FIGS. **2-3**, when adjoining hinges of three planar panels are aligned and the through holes of the two adjoining hinges are secured together, three planar panels are assembled into a spherical triangular unit. Preferably, as shown in FIG. **4**J, a through hole **140** of the hinge **111** and a through hole **141** of the hinge **122** are essentially the same in size.

According to an embodiment of the structure, at least one of the first, second and third planar panels comprise a material selected from a group consisting of aluminum, iron, steel, glass fiber, carbon fiber, plastic, wood and a combination thereof.

As shown in FIGS. **2-5**, the first, second and third planar panels comprise one or more inner ridges configured to accept or secure one or more intra-triangular-unit covers **150** that are configured to fit into and cover an intra-unit opening of the first triangular unit.

As shown in FIGS. **2-5**, the first, second and third planar panels comprise one or more outer ridges configured to accept or secure one or more inter-triangular-unit covers **151** that are configured to fit into and cover an inter-unit opening of adjacent spherical triangular units.

According to an embodiment, when there are two or more intra-triangular-unit covers, the structure further comprises a material filled between the two or more intra-triangular-unit covers. The material is preferably intended for use in thermal insulation, mechanical enforcement, fire prevention, noise reduction, vibration reduction or a combination thereof.

According to an embodiment, when there are two or more inter-triangular-unit covers, the structure further comprises a material filled between the two or more inter-triangular-unit covers. The material is preferably intended for use in thermal insulation, mechanical enforcement, fire prevention, noise reduction, vibration reduction or a combination thereof.

Preferably, as shown in FIGS. **2-4**, each planar panel comprises two inner ridges on a surface of the planar panel facing an inside of a spherical triangular unit assembled from the planar panel and two additional planar panels; each planar panel further comprises two outer ridges on a surface of the planar panel facing an outside of the spherical triangular unit assembled from the planar panel and two additional planar panels.

FIG. **3** is a perspective view showing the assembled first triangular unit according to an embodiment. FIG. **4** shows the planar panels **110**, **120** and **130** of the first triangular unit comprising inner and outer ridges. As shown in FIG. **3**, FIG. **4**A, **4**D, **4**G the first planar panel **110** comprises inner ridges **113** and **114** on a surface of the first planar panel facing inside the first triangular unit when assembled, and comprises outer ridges **115** and **116** on a surface of the first planar panel facing an outside the first triangular unit when assembled. As shown in FIG. **3** and FIGS. **4**B, **4**E, **4**H, the second planar panel **120** comprises inner ridges **123** and **124** on a surface of the second planar panel facing the inside the first triangular unit when assembled, and comprises outer ridges **125** and **126** on a surface of the second planar panel facing the outside the first triangular unit when assembled. As shown in FIG. **3** and FIGS. **4**C, **4**F, **4**I, the third planar panel **130** comprises inner ridges **133** and **134** on a surface of the third planar panel facing the inside the first triangular unit when assembled, and comprises outer ridges **135** and **136** on a surface of the third planar panel facing outside the first triangular unit when assembled.

In FIGS. **4**A-B, an inner ridge or an outer ridge is concentric to an end surface of a planar panel that comprises such inner ridge or outer ridge. According to an embodiment as shown in FIG. **4**A, two inner ridges **113** and **114** of the first planar panel **110** are concentric to the first end surface **101**; as shown in FIG. **4**B, two inner ridges **123** and **124** of the second planar panel **120** are concentric to the second end surface **102**; as shown in FIG. **4**C, two inner ridges **133** and **134** of the third planar panel **130** are concentric to the third end surface **103**.

As shown in FIG. **5**, preferably, the ridges comprise a series of through holes along a direction that is substantially perpendicular to an end surface of a planar panel comprising such ridges. The through holes on the ridges are configured to accept or secure an intra- or inter-triangular-unit cover to the ridges.

As shown in FIGS. **5-8**, the structure further comprises a plurality of plates, configured to connect the first spherical triangular unit to the third spherical triangular unit, and to connect the second spherical triangular unit to the third spherical triangular unit.

As shown in FIGS. **5-8**, the structure further comprises a plurality of fasteners configured to join a plurality of plates to the first, second or third spherical triangular units through a plurality of through holes on the first, second or third spherical triangular units. At least one of the plurality of fasteners comprises a ring configured to accept wiring therethrough.

FIG. **6** is an explosion view of a portion of an embodiment showing interconnection of three spherical triangular units through a plurality of plates and fasteners. FIG. **8**A is a top view according to the embodiment. FIG. **8**B is a bottom view according to the embodiment. As shown in FIG. **6**, three spherical triangular units are configured to be interconnected together through three adjoining corners by an outer plate **1000**, an inner plate **1001**, fasteners **1002**, **1003**, **1004** and nuts **1005**, **1006** and **1007**.

As shown in FIGS. **6**, **7**F and **7**H, the outer plate **1000** is a substantially triangular shaped plate with smooth corners, with one through holes at each smooth corner. The outer plate **1000** comprises a surface contour that substantially conforms to the corresponding contact surface of the adjoining three spherical triangular units to be interconnected. The outer plate **1000** contacts hinge portions of the end surfaces of the three spherical triangular units to be interconnected.

As shown in FIGS. **6**, **7**G and **7**I, the inner plate **1001** is a substantially triangular shaped plate with smooth corners, with one through hole at each smooth corner. The inner plate **1001** comprises a surface contour that substantially conforms to the corresponding contact surface of the adjoining three spherical triangular units to be interconnected. The inner plate **1001** contacts hinge portions of the inner end surfaces of the three spherical triangular units to be interconnected.

As shown in FIGS. **6** and **8**, three through holes of the outer plate **1000** are configured to be aligned with through holes of the hinges of three spherical triangular units, and with the three through holes of the inner plate **1001**. Such a configuration allows the securing of the aligned outer plate **1000**, three spherical triangular units and the inner plate **1001** by fasteners. Through the connection with the two plates one on each side of three triangular units, three triangular units are interconnected together securely.

As shown in FIGS. **6** and **7**A, fasteners **1002**, **1003** and **1004** are essentially the same. A fastener may comprise a ring on an end configured to accept wiring therethrough. Such wirings are useful for attaching additional elements to the structure. Such an element may comprise a surface covering material, such as to provide additional functions in thermal insulation, water resistance, heat tolerance, mechanical reinforcement, etc.

As shown in FIG. **7**A, a fastener **1002** comprises a first ring **1010** on an end, a threaded portion **1011**, a non-threaded portion **1013**, and a second ring **1012** on another end. Both rings **1010** and **1012** are configured to accept wirings therethrough. The threaded portion **1011** is configured to accept a matching nut **1005**. The width of the threaded portion **1011**, the unthreaded portion **1013** and the second ring **1012** are substantially the same, and are substantially the same as the inner width of the through holes of the hinges of a spherical triangular unit to be interconnected, and the inner width of the through holes of the inner plate **1001**. The width of the first ring **1010** is substantially larger than the width of the unthreaded portion, and the width of the through holes of the outer plate **1000**.

As shown in FIGS. **6** and **8**B, nuts **1005**, **1006** and **1007** are respectively connected to a fastener on its threaded portion, to complete the interconnection of three spherical triangular units. As shown in FIGS. **6**, **7**D and **7**E, nuts **1005**, **1006** and **1007** are essentially the same, and each of the nuts has an inner diameter that is substantially the same as the diameter of a threaded portion of a matching fastener.

As shown in FIG. **9**, the structure further comprises a first plurality of spherical triangular units, each of which is essentially identical to the first spherical triangular unit; the second spherical triangular unit is essentially identical to the first

spherical triangular unit; the first plurality of spherical triangular units and the first and second spherical triangular units are essentially equally spaced radially along the third great circle, and constitute a first level of the structure.

As shown in FIGS. **9-10**, the structure further comprises a second plurality of spherical triangular units, each of which is essentially identical to the third spherical triangular unit; wherein the second plurality of spherical triangular units and the third spherical triangular unit are essentially equally spaced radially relative to a center of the sphere **10** (see FIG. **10**), and constitute a second level of the structure.

According to embodiments in FIGS. **10-11**, the structure further comprises a plurality of levels comprising a plurality of spherical triangular units; the plurality of spherical triangular units on one level of the plurality of levels are essentially identical to each other, and are essentially equally spaced radially relative to the center of the sphere; each of the plurality of spherical triangular units located on a level above the first level comprises three planar panels, each with an end surface comprising a minor arc of a great circle of the sphere; a spherical triangular unit on a level above the first level of the structure is configured to be joined with two neighboring spherical triangular units on the level below; the structure is substantially a dome.

According to embodiments as shown in FIGS. **10** and **11**, the structure essentially forms a dome structure. The structure has essentially a spherical surface that matches the sphere **10**. The number of structural units, i.e. the spherical triangular units, on each level of the structure may be adjusted. Increasing the number of the spherical triangular units will increase the density and the mechanical strength of the overall structure. The number of the spherical triangular units may be designed with consideration of mechanical strength, usefulness and practicality, thereby allowing building dome structures of different overall sizes.

The design of inner or inter-triangular-unit covers substantially completes the look and function of the dome structure. According to an embodiment, inner or inter-triangular-unit covers may comprise surface contour that substantially conform to a portion of the surface of the sphere **10**, such that the dome structure extremely approximates an ideal hemisphere surface of the sphere.

According to an embodiment as shown in FIGS. **12-15**, the structure comprises a connector **2000**. As shown in FIG. **12**, the connector comprises an upper wall **2001**, a lower wall **2002**, one or more outer circular walls **2003** and one or more inner circular walls **2004**. One of the one or more outer circular walls **2003** is an extended part of the upper wall **2001** or the lower wall **2002**. One of the one or more outer circular walls **2003** and one of the one or more inner circular walls **2004** are configured to form a circular slot **2005** between the outer circular wall and the inner circular wall.

According to an embodiment, the inner and outer circular walls and the circular slots are in cylindrical shapes.

According to an embodiment, the inner and outer circular walls and the circular slots are in conical or funnel shapes.

According to an embodiment as shown in FIGS. **14-15**, the connector **2000** is configured to accommodate a plurality of ends of a plurality of planar panels in the circular slot to connect a plurality of spherical triangular units.

Preferably, the connector is configured to connect each end of the planar panels of three spherical triangular units in the circular slot.

Preferably, as shown in FIG. **14-15**, each end of a planar panel comprises a stem **301** and a head **302**. The head is configured to fit in the circular slot **2005**, and engaged by the upper wall, the lower wall and the inner and outer circular walls.

According to an embodiment as shown in FIG. **14-15**, each planar panel extends from an end surface **303** to an inner end surface **304**, which comprises an arc concentric with the end surface **303**. Each planar panel comprises an array of protrusions **305** along the end surface **303** and an array of protrusions **306** along the inner end surface **304**.

According to an embodiment as shown in FIG. **15**, the dome structure has an enclosed inner hemispherical space with a diameter "r". The inner end surfaces of planar panels of all spherical triangular unites are arranged at a distance "r" from a center of the dome structure; the end surfaces of planar panels of all spherical triangular unites are arranged at a distance R from a center of the dome structure.

According to an embodiment as shown in FIG. **12**, the connector **2000** comprises a top connector piece **2010** and a bottom connector piece **2020**. The top connector piece **2010** comprises an upper wall **2001** and an inner circular wall **2004**. The bottom connector piece **2020** comprises a lower wall **2002** and an inner circular wall **2004**. The top connector piece **2010** and the bottom connector piece **2020** are configured to be securely joined.

Preferably, the upper wall is toward the exterior of the dome, and the lower wall is toward the interior of the dome.

According to an embodiment as shown in FIGS. **12**B and **12**C, the top connector piece **2010** further comprises a first top handle **2011** and a second top handle **2012**; the bottom connector piece **2020** further comprises a first bottom handle **2021** and a second bottom handle **2022**.

According to an embodiment, the first top handle and second top handle are configured to facilitate the installation of the top connector piece. The first top handle or the second top handle may also be configured to accept a wiring, a hook, an additional attachable element, etc., therethrough.

According to an embodiment, the first bottom handle and second bottom handle are configured to facilitate the installation of the bottom connector piece. The first bottom handle or the second bottom handle may also be configured to accept a wiring, a hook, or an additional attachable element, etc., therethrough.

According to an embodiment as shown in FIGS. **12**A and **14**, the top connector piece **2010** comprises an internal thread **2013**; the bottom connector piece comprises an external thread **2023**. The top connector piece **2010** and the bottom connector piece **2020** are configured to be securely joined by the internal thread **2013** and the external thread **2023**.

According to an embodiment as shown in FIGS. **12** and **14**, the top connector piece **2010** comprises a top through hole **2014** in a center of the top connector piece **2010**; the bottom connector piece **2020** comprises a bottom through hole **2024** in a center of the bottom connector piece. The top through hole **2014** and the bottom through hole **2024** are configured to align to form a holding space **2007**.

According to an embodiment the holding space **2007** has an opening on the upper wall and an opening on the lower wall.

According to an embodiment, the structure further comprise additional elements such as a control system, a power cable or system, a security system, an energy generation system, a heating system, a communication cable or system, a transmission cable or system, a food or water transit cable or system, a display or notification system, an alarm system, a speaker system, a battery system, an air conditioning system, a filtration system, a lighting system, or a device or a material

that is adapted to provide for life and survival in a disaster situation such as tornadoes, hurricanes, or earthquakes.

According to an embodiment such additional elements may be accommodated in the holding space **2007**.

According to an embodiment as shown in FIGS. **12-13**, the structure further comprise a lighting device in the holding space.

According to an embodiment as shown in FIG. **13**, the lighting device **2030** comprises a solar panel **2031**, a battery **2032**, a casing **2033** that is configured to be secured within the holding space, and a LED light **2034**.

According to an embodiment, the solar panel has a diameter larger than the diameter of the opening of the top through hole **2014** on the upper wall. The casing has a diameter smaller than the diameter of the opening of the top through hole **2014** on the upper wall. The solar panel and the casing is configured to be pre-assembled together and installed from the top through hole.

According to an embodiment, the solar panel is oriented at a direction toward the exterior of the dome, so as to collect solar energy from sunlight received by the exterior surface of the dome.

According to an embodiment, as shown in FIG. **13**, the solar panel **2031** comprises an array of panels.

According to an embodiment, the LED light has a diameter larger than the diameter of the opening of the bottom through hole **2024** on the lower wall. The LED light is configured to be pre-assembled. The battery and the LED light are configured to be installed from the bottom through hole. The LED light, the battery, the solar panel and the casing are configured to be securely connected together by fasteners such as screws.

According to an embodiment, the LED light is oriented at a direction toward the interior of the dome, so as to provide lighting to the interior of the dome.

According to an embodiment, the color and patterns on the LED lights are variable. According to an embodiment as shown in FIG. **13**, one of the patterns on the LED lights is in star shapes.

According to an embodiment, an apparatus comprises said connector.

According to an embodiment, the apparatus is a toy, a game, a model or a tool.

According to an embodiment, preferably, the structure further comprises a first plurality of spherical triangular units, each of which is essentially identical to the first spherical triangular unit; the second spherical triangular unit is essentially identical to the first spherical triangular unit; wherein the first plurality of spherical triangular units and the first and second spherical triangular units are essentially equally spaced radially along the third great circle, and constitute a first level of the structure.

According to an embodiment, preferably, the structure further comprises a second plurality of spherical triangular units, each of which is essentially identical to the third spherical triangular unit; wherein the second plurality of spherical triangular units and the third spherical triangular unit are essentially equally spaced radially relative to a center of the sphere, and constitute a second level of the structure.

According to an embodiment, preferably, the structure further comprises a plurality of spherical triangular units; the plurality of spherical triangular units on one level of the plurality of levels are essentially identical to each other, and are essentially equally spaced radially relative to a center of the sphere; each of the plurality of spherical triangular units located on a level above the first level comprises three planar panels, each with an end surface comprising a minor arc of a great circle of the sphere; a spherical triangular unit on a level above the first level of the structure is configured to be joined with two neighboring spherical triangular units on the level below; the structure is substantially a dome.

The structure may further comprise a foundation of concrete and reinforced steel bars, for providing security and strength.

According to an embodiment, one spherical triangular unit on the first level of the structure is interconnected with a neighboring spherical triangular unit on the first level and with the foundation of the structure by an outer plate, an inner plate, one or more fasteners and bolts.

The structure may further comprise windows and entryways. Windows may be designed to fit within an intra-unit or an inter-unit opening of the spherical triangular units, or may be designed as a skylight at the top of the structure. Entryways may be designed as a cut out of the structure.

The structure of this disclosure has a superior ability to survive disasters such as tornadoes, hurricanes, earthquakes etc. It is cost-efficient, energy efficient, extremely durable and easily maintained. It is also easy to assemble from prefabricated parts. The structure can be constructed on virtually any site such as in the mountains, on beaches, even underground or underwater without requiring large and heavy construction equipments. The structure, when properly designed with considerations of the need of its users, may be adapted as homes, offices, schools, churches, storages, emergency shelters and so on.

In relation to the claims, it is intended that when words such as "a," "an," "at least one," or "at least one portion" are used to preface a feature there is no intention to limit the claim to only one such feature unless specifically stated to the contrary in the claim.

The descriptions above are intended to be illustrative, not limiting. Thus, it will be apparent to one skilled in the art that modifications may be made without departing from the scope of the claims set out below.

What is claimed is:

1. A structure comprising a first spherical triangular unit, a second spherical triangular unit and a third spherical triangular unit;

the first spherical triangular unit comprising a first planar panel, a second planar panel and a third planar panel;

the second spherical triangular unit comprising a fourth planar panel, a fifth planar panel and a sixth planar panel;

the third spherical triangular unit comprising a seventh planar panel, an eighth planar panel and a ninth planar panel;

the first planar panel comprising a first end surface, the second planar panel comprising a second end surface, the third planar panel comprising a third end surface;

the fourth planar panel comprising a fourth end surface, the fifth planar panel comprising a fifth end surface, and the sixth planar panel comprising a sixth end surface;

the seventh planar panel comprising a seventh end surface, the eighth planar panel comprising an eighth end surface, and the ninth planar panel comprising a ninth end surface;

wherein the first end surface comprises a minor arc of a first great circle of a sphere;

wherein the second end surface comprises a minor arc of a second great circle of the sphere;

wherein the third end surface comprises a minor arc of a third great circle of the sphere;

wherein the fourth end surface comprises a minor arc of a fourth great circle of the sphere;

wherein the fifth end surface comprises a minor arc of a fifth great circle of the sphere;

wherein the sixth end surface comprises a minor arc of the third great circle of the sphere;

wherein the seventh end surface comprises a minor arc of a seventh great circle of the sphere;

wherein the eighth end surface comprises a minor arc of an eighth great circle of the sphere;

wherein the ninth end surface comprises a minor arc of a ninth great circle of the sphere;

wherein the seventh planar panel and the ninth planar panel join and form a corner of the third spherical triangular unit, the first planar panel and the second planar panel join and form a corner of the first spherical triangular unit, the corner of the first spherical triangular unit is connected to the corner of the third spherical triangular unit; and

wherein the eighth planar panel and the ninth planar panel join and form another corner of the third spherical triangular unit, the fourth planar panel and the fifth planar panel join and form a corner of the second spherical triangular unit, the other corner of the third spherical triangular unit is connected to the corner of the second spherical triangular unit.

2. The structure of claim **1**, wherein central angles of the first end surface, second end surface, third end surface, fourth end surface, fifth end surface and sixth end surface are essentially the same.

3. The structure of claim **1**, wherein central angles of the seventh, eighth and ninth end surfaces are essentially the same.

4. The structure of claim **1**, wherein

the first planar panel extends from the first end surface toward a center of the sphere along a surface of the first great circle;

the second planar panel extends from the second end surface toward the center of the sphere on a surface of the second great circle; and

the third planar panel extends from the third end surface toward the center of the sphere on a surface of the third great circle.

5. The structure of claim **4**, wherein the first planar panel extends from the first end surface to a first inner end surface which comprises an arc concentric with the first end surface; wherein the second planar panel extends from the second end surface to a second inner end surface which comprises an arc concentric with the second end surface; wherein the third planar panel extends from the third end surface to a third inner end surface which comprises an arc concentric with the third end surface.

6. The structure of claim **5**, wherein central angles of the first, second, and third inner end surfaces are essentially the same.

7. The structure of claim **5**, wherein radii of the first, second, and third inner end surfaces are essentially the same.

8. The structure of claim **1**, wherein the first and the second planar panel are joined by a hinge; wherein the second and third planar panels are joined by a hinge; wherein the first and third planar panels are joined by a hinge.

9. The structure of claim **1**, wherein the first, second and third planar panels comprise one or more inner ridges configured to accept or secure one or more intra-triangular-unit covers that are configured to fit into and cover an intra-unit opening of the first triangular unit.

10. The structure of claim **1**, wherein the first, second and third planar panels comprise one or more outer ridges configured to accept or secure one or more inter-triangular-unit covers that are configured to fit into and cover an inter-unit opening of adjacent spherical triangular units.

11. The structure of claim **1**, further comprising a plurality of plates, configured to connect the first spherical triangular unit to the third spherical triangular unit, and to connect the second spherical triangular unit to the third spherical triangular unit.

12. The structure of claim **11**, further comprising a plurality of fasteners configured to join the plurality of plates to the first, second and third spherical triangular units through a plurality of through holes on the first, second and third spherical triangular units.

13. The structure of claim **12**, wherein at least one of the plurality of fasteners comprises a ring configured to accept wiring therethrough.

14. The structure of claim **1**, wherein at least one of the first, second and third planar panels comprises a material selected from a group consisting of aluminum, iron, steel, glass fiber, carbon fiber, plastic, wood and a combination thereof.

15. The structure of claim **1**, wherein the ninth great circle passes through an intersection of the first end surface and the second end surface and passes through an intersection of the fourth end surface and the fifth end surface; wherein the ninth end surface is a minor arc of the ninth circle between the intersection of the first end surface and the second end surface and the intersection of the fourth end surface and the fifth end surface.

16. The structure of claim **1**, further comprising a first plurality of spherical triangular units, each of which is essentially identical to the first spherical triangular unit; the second spherical triangular unit is essentially identical to the first spherical triangular unit; wherein the first plurality of spherical triangular units and the first and second spherical triangular units are essentially equally spaced radially along the third great circle, and constitute a first level of the structure.

17. The structure of claim **16**, further comprising a second plurality of spherical triangular units, each of which is essentially identical to the third spherical triangular unit; wherein the second plurality of spherical triangular units and the third spherical triangular unit are essentially equally spaced radially relative to a center of the sphere, and constitute a second level of the structure.

18. The structure of claim **17**, further comprising a plurality of levels comprising a plurality of spherical triangular units; the plurality of spherical triangular units on one level of the plurality of levels are essentially identical to each other, and are essentially equally spaced radially relative to a center of the sphere; each of the plurality of spherical triangular units located on a level above the first level comprises three planar panels, each with an end surface comprising a minor arc of a great circle of the sphere; a spherical triangular unit on a level above the first level of the structure is configured to be joined with two neighboring spherical triangular units on the level below; the structure is substantially a dome.

19. The structure of claim **1**, further comprising a connector, wherein the connector comprises an upper wall, a lower wall, one or more outer circular walls and one or more inner circular walls; wherein one of the one or more outer circular walls is an extended part of the upper wall or the lower wall; wherein one of the one or more outer circular walls and one of the one or more inner circular walls are configured to form a circular slot between the outer circular wall and the inner circular wall; wherein the connector is configured to accommodate a plurality of ends of a plurality of planar panels in the circular slot to connect a plurality of spherical triangular units.

20. The structure of claim 19, wherein the connector connects an end of each of the planar panels of three adjacent spherical triangular units to connect three adjacent spherical triangular units.

21. The structure of claim 19, wherein the connector comprises a top connector piece and a bottom connector piece; wherein the top connector piece comprises the upper wall and one of the one or more inner circular walls; wherein the bottom connector piece comprises the lower wall and one of the one or more inner circular walls; wherein the top connector piece and the bottom connector piece are configured to be joined.

22. The structure of claim 21, wherein the top connector piece further comprises a first top handle and a second top handle; wherein the bottom connector piece further comprises a first bottom handle and a second bottom handle.

23. The structure of claim 21, wherein the top connector piece comprises an internal thread; the bottom connector piece comprises an external thread; wherein the top connector piece and the bottom connector piece are joined by the internal thread and the external thread.

24. The structure of claim 21, wherein the top connector piece comprises a top through hole in a center of the top connector piece; wherein the bottom connector piece comprises a bottom through hole in a center of the bottom connector piece; wherein the top through hole and the bottom through hole are aligned to form a holding space.

25. The structure of claim 24, which further comprise a lighting device in the holding space; wherein the lighting device comprises a solar panel, a battery, a casing, and a LED light.

26. The structure of claim 19, wherein each end of a planar panel comprises a stem and a head; wherein the head is configured to fit in the circular slot, and engaged by the upper wall, the lower wall and the inner and outer circular walls.

27. The structure of claim 1, further comprising a control system, a power cable or system, a security system, an energy generation system, a heating system, a communication cable or system, a transmission cable or system, a food or water transit cable or system, a display or notification system, an alarm system, a speaker system, a battery system, an air conditioning system, a filtration system, a lighting system, or a device or a material that is adapted to provide for life and survival.

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